entire period of observation. A few were without the severe frontal, or postorbital, headache and painful occulomotion, that have heretofore been largely present in our experience. Many complained of sore throat, often without evidence of local inflammation or adenopathy. Many cases suffered an initial diarrhea, often with abdominal cramps, sometimes with vomiting, and occasionally with mental dullness or lack of power of concentration, suggestive of cerebral involvement. These appeared to be primary gastro-intestinal infections, some with, and some without, a generalized toxemia. Nearly every patient complained of some pain in the cervical or lumbar areas, but this was less severe, on an average, than formerly. Stiffness of the neck and spine was often absent, but in spite of this occasional flaccidity, spinal flexion, with stretch of the dura about the inflamed nerve roots, caused cervical or lumbar pain in most cases. This "spine sign" is usually the earliest neurological finding. Headache, or pain in the back or abdomen, induced or accentuated by slight trauma, was noticeable, even in those cases showing no increase in intrathecal pressure. The degree and duration of muscle pain, tenderness and severe cramping, were out of proportion to the motor phenomena. Some cases apparently suffered no premonitory symptoms, but developed neurological findings very suddenly at the onset.

*Signs.*—The objective findings were as atypical as the subjective symptoms. The frequency of a positive "spine sign" without spinal rigidity has been mentioned. Reflexes remained intact, although often diminished and frequently asymmetrical, in a large majority of cases. Muscle weakness was often very mild or transient, but pain on motion was sometimes pronounced. Frequently, muscle checks showed no weakness nor asymmetry, sometimes no pain, but a marked fatiguability of the affected extremity on repeated tests. In some cases there was a delayed fatiguability that was very persistent, and was aggravated by testing. Sensory phenomena seemed to be uniformly out of proportion to motor changes. Muscle tenderness was often acute. Hyperesthesia was pronounced, and in some cases was localized and contralateral to the paresis (Brown-Séquard phenomena, due to unilateral myelitis involving the lateral spinothalamic tract). An occasional case developed temporary surface anesthesia over areas corresponding to the nerve distribution from individual cord segments. In some cases the degree of abdominal pain, distention, and vomiting, was quite alarming, but absence of abdominal rigidity precluded the probability of peritoneal inflammation, while associated urinary retention and lumbar and lower extremity pains seemed to incriminate the sympathetic and central nervous systems. Also, the sudden relief after spinal puncture, even in cases showing no increased intrathecal pressure, indicated a paralytic ileus, a phenomenon not common in poliomyelitis, particularly of such low virulence. Further evidence of sympathetic involvement was the common finding of localized sweating over the surface of the affected extremity.

(To be continued)

# THE ORTHOPEDIC TREATMENT OF CHRONIC ARTHRITIS*

*By* ELLIS JONES, M. D.
*Los Angeles*

DISCUSSION *by LeRoy C. Abbott, M. D., San Francisco; Ralph Soto-Hall, M. D., San Francisco; Maynard C. Harding, San Diego.*

THE orthopedic treatment of chronic arthritis is directed in the earlier stages of the disease to the conservation of joint and muscle function and the prevention of deformity and in the later stages to the correction of deformity and reconstructive joint surgery. The conservation of joint and muscle function is accomplished by physical methods and demands both physiological rest and exercise. The principles of rest and exercise are more adequately applied when the constantly changing pathology occurring in both the major types of arthritis—atrophic arthritis, the so-called rheumatoid or proliferative type, and hypertrophic arthritis, the so-called degenerative or osteoarthritic type—is understood.

## PATHOLOGY

Atrophic arthritis begins in the soft tissues and fibrous structures surrounding the joint with the gradual spreading of inflamed tissue into the joint capsule and synovia in the presence of early and extreme bone atrophy, which constitutes a valuable early diagnostic sign. Later, marginal granulation tissue forms and creeps centrally over the articular cartilage as a vascular ring of pannus, which may entirely replace the articular cartilage. This process occurring over both of the articular surfaces of the joint, the opposing layers of granulation tissue may adhere to each other, becoming vascularized in the form of firmly organized connective tissue. Also, the connective tissue of the marrow, proliferating, contributes to form a vascular granulation tissue which extends up to and may even ulcerate through the overlying articular cartilage. Therefore, the cartilage of an atrophic joint may be destroyed either by the extension of granulation tissue over its surface or by the extension of granulation tissue from the marrow.

## LOCAL JOINT THERAPY AND SUPPORT

With this pathology clearly in mind, the importance of both physiological rest and exercise combined with the judicious employment of the physical methods in order to maintain joint motion and nutrition and muscular activity will be recognized. Rest to the atrophic joint is best obtained from the application of adequate braces and removable splints, having clearly in mind that the atrophic joint does not demand complete and continuous rest, but exercise as well. Absolute fixation of an atrophic joint by a plaster cast is contraindicated if we are endeavoring to preserve motion and prevent bony ankylosis. In general, braces are not applied sufficiently early in the management of atrophic arthritis. The initial onset of deformity is early and its progress rapid,

*Read before the General Medicine Section of the California Medical Association at the sixty-third annual session, Riverside, April 30 to May 3, 1934.

especially in the fingers, wrists, elbows, shoulders, and the small joints of the feet. The early application of a cock-up brace maintains the hand in excellent functional position, even if ankylosis of the wrist eventually occurs. Functional position of a shoulder is maintained in moderate abduction by a well-fitting aeroplane splint. The early application of a flexible arch support, modeled from plaster impressions of the feet, maintains comfortable weight bearing and prevents crippling deformities of the toes. A well-fitting corset or a light spinal brace is often a great relief to patients with this form of arthritis, since it relieves a constant forward strain of the erector spinae muscles and corrects a tendency to kyphosis. Rest to the knee joint and prevention of a flexion deformity is best accomplished by any type of brace similar to the Thomas caliper. In patients with hip joint involvement, a weight-bearing ischial ring is incorporated in a simple caliper. No matter what type of brace is employed, it is well to remember that continuous fixation of the atrophic joint is to be avoided. I like to think of braces and splints as being simply adjuncts to the still more valuable treatment by both the medical and physical methods.

The purpose of all forms of physical treatment, namely, the employment of heat, electrical treatment, massage, exercise and heliotherapy, is to maintain skin, muscle and joint nutrition and function until the acute process has subsided. It is not a simple matter to indicate when the disease is no longer active, although the absence of pain and the increasing ability to move a joint are helpful signs.

Dry heat is applied by infra-red light or an electric pad. The use of moist heat often proves more grateful to the affected joint and may be applied by the use of epsom salt soaks or hot packs, mud packs and hot baths.

In a more specialized effort to apply heat, diathermy, a rapidly alternating form of high frequency current, is a two-edged sword, and, when prescribed in the treatment of atrophic joints, increases pain and joint congestion, particularly in the presence of even a mild joint effusion. Any effusion of a joint, no matter how slight, is far better treated by early aspiration.

All treatment involving the use of local heat should be followed by either massage or movements as a routine. In the case of local muscular or fibrous induration, massage is preferable in order to break up the products of inflammation so that they may be removed by the blood and lymph circulation which are at their best as the result of thermal treatment. Movement always is preferable to massage where the affected structure is a joint and is indicated in all forms of muscular wasting. Physiological exercise of the musculature about an arthritic joint can be obtained best by the use of the Bristow-Smart coil, which produces painless graduated muscular contraction by the Farradic current. This is an exact physiological duplication of exercise and has the extraordinary advantage of producing muscle exercise when active voluntary joint and muscle movement is unwise. The Morton Smart unit produces a greater inflow and outflow of blood in the affected tissues, actually stimulating joint repair and increasing absorption of serum, lymph and inflammatory exudate. In our experience with this method, it has obviated the use of massage, since the muscular contraction of itself accelerates circulation locally.

The value of massage is distinctly overrated. Massage alone is useless, and no inflamed joint should ever be massaged, although the nutrition of the muscles about an affected joint may be maintained by massage. Graduated muscular contractions or active voluntary motion, are infinitely superior. It is unfortunate, also, that massage in the treatment of arthritis is too generally understood to include joint manipulation; although it is important that any affected joint should go through a full range of motion daily and with help, if necessary, yet manipulation to include forced passive motion is a traumatic insult to an atrophic joint. Only in the late stage of atrophic arthritis, when ankylosis seems inevitable, is manipulation justified to place a joint in good functional position.

We believe that heliotherapy is of distinctly limited value in the treatment of any patient with acute atrophic arthritis. Such a patient is fatigued and toxic. Complete bed rest, preferably in the open air, is good treatment not only for the patient, but also for the joints, and heliotherapy, while useful in restricted dosage, too often contributes to the general exhaustion of the patient. It is also during the acute, inflammatory stage of atrophic arthritis that local joint therapy, as well as heliotherapy, is too vigorously employed.

### OPERATIVE TREATMENT

Operative treatment occupies a relatively small place in the treatment of atrophic arthritis. The early aspiration of joint effusion and the correction of deformities by tenotomies, osteotomies, and capsulotomies is common orthopedic practice. The operative fixation of a joint is indicated when a few degrees of painful motion are present in a joint, making it unfit for weight bearing, since a rigid but painless joint arthrodesed in good functional position is distinctly preferable to a movable, painful joint. Reconstructive surgery in the atrophic type of arthritis is never to be considered until all joint activity has been absent for at least six months. Arthroplasty, the formation of a new joint as a substitute for an atrophic ankylosed joint, is particularly successful in mobilizing the elbow, hip and knee joints. Osteotomy is more commonly employed for the correction of flexion deformities of the knee joints and ankylosis of the hip joints with excessive adduction, the so-called "scissors deformity." We have not found it necessary to fuse a sacroiliac or any other spinal joint in the surgical treatment of chronic atrophic arthritis.

### HYPERTROPHIC ARTHRITIS

Hypertrophic arthritis, the so-called osteoarthritic or degenerative type, is at present considered a degenerative disease affecting the articular cartilage and particularly the weight bearing sur-

faces of joints after middle life. The brunt of the damage in hypertrophic arthritis is borne by the articular cartilage in the underlying bone. The articular cartilage undergoes erosion, local atrophy, proliferation, replacement by fibrous tissue, marginal osteophytic lipping, and detachment of articular areas often forming loose bodies or "joint mice." There is a gradual, progressive enlargement of the bony ends of the joint with new bone formation, which often mechanically limits the motion of the joint itself. The articular cartilage degenerates in the central portion where the pressure of the opposing surfaces is greatest. Heberden's nodes may occur at any stage of the disease. The condition occurs most frequently in the knee, hip and spinal joints. Complete bony ankylosis seldom takes place. The tendency of atrophic arthritis to spread to many joints is not seen in hypertrophic arthritis. The sufferers from hypertrophic arthritis are generally well nourished, active individuals in whom simple or repeated traumata seems to play an important part in the onset and exacerbation of joint symtoms.

### LOCAL THERAPY AND SUPPORT TO JOINT

This form of arthritis can be helped considerably by suitable orthopedic appliances. A walking caliper with the weight of the body taken by an ischial ring is useful in a monoarticular affection of the hip, but it demands exact fitting to avoid being a nuisance rather than a help. A well-fitting spinal brace with a moulded pelvic sheath and with axillary crutches incorporated, if necessary, by relieving the static overload on hypertrophic spinal joints in obese or heavy set individuals, will often afford a striking relief of back symptoms when all other forms of treatment have failed. It is well to gradually discontinue use of a brace when the acute symptoms subside and to substitute some form of corset or sacro-iliac support. Static strain greatly aggravates otherwise minor symptoms, especially in hypertrophic knee joints, and the judicious employment of arch support will not only relieve subacute symptoms in these joints, but in the hip and lower spinal joints as well.

The use of traction to arthritic joints, both atrophic and hypertrophic, is of distinct value in furnishing early relief to rapidly flexing and acutely painful knee and hip joints and may be advantageously employed in conjunction with either brace or splint fixation.

Physical methods of treatment are unusually successful in relaxing muscle spasm, increasing blood circulation, and maintaining joint function and nutrition. Baths and spa treatment have a very distinct place in the treatment of hypertrophic arthritis. Infra-red light, diathermy, and massage relieve pain, and massage, not only of the muscles but of the joints themselves, is not only permissible, but desirable. We have obtained the best results in local joint therapy, however, by the persistent use of cataphoresis in the form of potassium iodid ionization, the application of a strong galvanic current with the electrode pads soaked in a solution of potassium iodid which is easily dissociable by electricity.

### OPERATIVE TREATMENT

Operation is justified at any time in the course of hypertrophic arthritis when surgery offers definite improvement; for example, the removal of loose bodies, the surgical stabilization of an acutely painful or rapidly deforming hip joint, or the excision of a femoral head to restore hip joint motion. We have found that synovectomy of the knee joint, the systematic removal, total or partial, of hypertrophied synovial membrane, including both meniscii and the hypertrophied retropatellar pad, give excellent results, particularly when the soft tissues are greatly hypertrophied and if the arthritis is not too far advanced. In an ankylosis of both hip joints, we prefer to reconstruct a single joint. The reconstruction operation has always included excision of the femoral head. A simple excision of the head can be rapidly performed, and with or without reconstruction of the femoral neck, has given good results. After the head is removed, the leg is abducted in a plaster cast for from six to eight weeks until the neck is securely fixed in the acetabulum. We have reserved simple excision of the femoral head to restore mobility in older patients in whom both hips are ankylosed. In younger patients, we have utilized both the Albee and the Whitman methods of reconstruction of the hip joint. In both operations the femoral head is excised, and a reconstruction of the neck is done. In the Whitman operation the greater trochanter with its muscular attachments is freed and transplanted laterally downward. We believe that both procedures are of equal advantage.

Although we have often performed an arthrodesis of the hip to stabilize a hypertrophic arthritic joint, we have found bony union difficult to obtain. Consequently, we now prefer to do some type of reconstruction operation, particularly since restoration of mobility in the hip joint is infinitely more appreciated by the patient than a stable joint.

We have found arthroplasty of the hip joint to be attended with particularly favorable results in chronic hypertrophic arthritis.

Chilotomy, the removal of osteophytes around the femoral head and acetabulum, has given indifferent results, and, although it may result in increased joint movement and considerable relief of pain, the result should not be guaranteed. This operation is being replaced by one of the various methods of hip joint reconstruction.

We have had no personal experience with the bifurcation operation for the relief of hip joint deformity in hypertrophic arthritis.

Manipulation in the hypertrophic type of arthritis is of debatable value. We have obtained striking results in the manipulation of an early hypertrophic hip joint, particularly when manipulation has been followed by direct traction and reinforced by judicious joint nursing. Manipulation has a particular field of usefulness in the various types of periarthritis, rather than in true intra-articular disease. Periarthritic adhesions about the shoulder joint are manipulated with complete recovery, but the manipulation of a

shoulder in atrophic arthritis is attended with great risk of fracture of atrophied bone and rapidly increasing synovial hypertrophy in the presence of acute inflammation and increasing fibrosis. A joint in which a simple fibrosing capsulitis can be demonstrated with limitation of motion in only one or two directions can be manipulated safely. A manipulation of the back in the presence of gross hypertrophic changes gives temporary relief, but it seems unreasonable to expect any lasting benefit.

There is a form of arthritis commonly seen in women past middle age which is characterized by massive synovial hypertrophy, joint effusion, and soft tissue thickening. It usually affects the knee joints and is perhaps a condition of chronic proliferative synovitis, rather than a true arthritis. It is often curable in the early stages by conservative measures. In my personal experience, I have found it to be invariably cured by a complete synovectomy. The particular indication for surgical interference in this form of arthritis is that, if it is untreated, it becomes in the course of time a hypertrophic arthritis, with major degenerative changes indistinguishable from the usual form of the disease.

## IN CONCLUSION

It will be seen from this brief résumé that the indications for operative treatment in chronic arthritis are distinctly limited and sharply defined. There are still a large number of patients seriously crippled by chronic arthritis who must seek relief from reconstructive surgery, but it is now becoming increasingly possible in general practice with better treatment at an earlier stage to cure or arrest chronic arthritis by conservative methods before it has progressed to the point where operative treatment is needed.

1136 West Sixth Street

## DISCUSSION

LeRoy C. Abbott, M. D. (384 Post Street, San Francisco).—In this paper Doctor Jones has stressed the importance of a thorough understanding of the pathology in the two principal types of arthritis—the atrophic or proliferative, and the hypertrophic or degenerative type. In the former there is a tendency to ankylosis; in the latter, limitation of motion is the rule, without complete stiffening of the joint.

In atrophic arthritis the failure to apply the fundamental principles of treatment early in the course of the disease often leads to ankylosis of the joint with deformity. Recognition of this type of arthritis, with application of splints for rest and support, the use of active motion, the elimination of the causes of disease and the building up of the patient's general condition frequently result in the arrest of the condition. In the degenerative or hypertrophic form of arthritis, local support to the affected joint and physical therapy are of use in the relief of symptoms and the preservation of motion. The prevention of strain, of overweight, overuse of the joint, and the application of the principles of rest, with the elimination of trauma, are essential.

Operation is beneficial in the type of arthritis in properly selected cases, and its field of usefulness is especially seen when the hip joint is involved. In hypertrophic arthritis of this joint, arthrodesis often fails. Excision of the head or some type of reconstructive operation yields more favorable results. In the early cases with slight change in the cartilage, manipulation under anesthesia may yield satisfactory results and improve function over a period of several years. Manipulation is also indicated for correction of deformity and the prevention of mechanical strain.

The author has sounded a note of optimism in the treatment of patients affected with arthritis. In recent years, by its early recognition and the early institution of sound principles of treatment, the arrest of the disease has occurred in many instances before marked destruction of the joint and deformity have taken place. By the intensive study now being given to the disease and through the coöperation of various men in special fields, we can hope for further advances in the elimination of the causes and effects of this common and crippling condition.

*

Ralph Soto-Hall, M. D. (350 Post Street, San Francisco).—I wish to stress the benefit which can be obtained from certain methods of traction in suitable cases of arthritis. These can be divided into different groups. In the acute stage of arthritis of the knee or hip, the relief experienced from simple extension is common knowledge. Similar relief can be also obtained from a combination of bilateral leg traction, plus a pelvic sling in cases of sacro-iliac arthritis. The benefit from this may be the result of actual improvement in some mechanical derangement of this intricate joint. Traction also has a large place in the treatment of chronic arthritis. Of definite value is the balanced traction of Steindler, to overcome contractures of the knee in atrophic arthritis. This method involves skin traction along the axis of the tibia, combined with an upward sling resting beneath the proximal third of the calf. This avoids the usual posterior subluxation which occurs on correction of this deformity by other means. A countertraction is obtained by a sling under the thigh. The weight on this is reduced as the flexion is diminished.

A similar arrangement of traction can be employed to overcome certain contractures of the hip joint. I have found of particular value the use of double skin traction in the shoulder, to restore loss of abduction and external rotation after inflammatory changes in the joint. The patient is placed in bed in the semi-Fowler position, with seven to ten pounds of skin traction along the axis of the humerus, and the shoulder abducted as much as possible. The elbow is flexed to 90 degrees and another traction is applied along the forearm, but with the pull toward the head of the bed. This is gradually increased and thus external rotation is regained.

The author has given an excellent review of the various operative procedures, and in passing I would like to emphasize particularly the opportunities that are open to us in hypertrophic arthritis of the hip joint, where remodeling operations and partial arthroplasties are accompanied with definite success.

*

Maynard C. Harding, M. D. (Medico-Dental Building, San Diego).—Doctor Jones, in his paper, expresses a viewpoint rather more conservative than that of most orthopedic surgeons on the Pacific Coast, and one in which I am wholly in accord.

The orthopedic attack on arthritis still centers on rest and support. Manipulative treatment finds success mainly in the peri-articular affections, while its worst failures are in the infective atrophic types. Doctor Jones has done well to stress the limitations of heat treatment, and to point out the necessary adjuncts to such treatment when given. No single therapeutic agent is today so overused and misused as heat. It sometimes seems to me that the profession has given over its thinking on this subject to the makers of heating apparatus. Heat has its uses, to be sure, but let us apply it in accord with the principles of physiology.

This paper well deserves a thoughtful reading. It will do us all good to apply its statements to our present conceptions of arthritis, in order that we may bring ourselves abreast of the best current orthopedic treatment.